

## **REMARKS**

### **Cancelled Claims**

Claims 13-16 have been cancelled without prejudice. Applicants reserve the right to prosecute these claims in one or more continuing applications. Accordingly, all pending rejections are rendered moot with regard to these claims.

### **Rejection Based On Andreasson Under 35 U.S.C. § 103(a)**

The Examiner rejects claims 1, 5-8 and 10-12 under 35 U.S.C. §103(a) as being unpatentable over WO 99/39809 ("Andreasson"). Applicants respectfully traverse this rejection.

The Examiner asserts that Andreasson teaches a system for the reduction of nitrogen oxides in exhaust gases that incorporates an oxidation catalyst to convert at least a portion of NO to NO<sub>2</sub>, a particulate filter, a source of reductant such as ammonia and a SCR (selective catalytic reduction) catalyst. Further, the Examiner asserts that Andreasson teaches that the SCR catalyst comprises a transition metal/zeolite SCR catalyst and that the oxidation catalyst may be platinum aluminum oxide deposited on a honeycomb carrier. The Examiner concludes that it would have been *prima facie* obvious to one of ordinary skill in the art at the time that the invention was made to expect the exhaust gas to contain 30-70 vol. % of nitrogen dioxides before contact with the reduction catalyst. Because of this, the Examiner concludes that Andreasson renders the present invention unpatentable.

Applicants respectfully disagree with the Examiner. To establish obviousness of a claimed invention, all claim elements must be taught or suggested by the prior art. Andreasson discloses a system for NO<sub>x</sub> reduction in combustion gases that incorporates an oxidation catalyst to convert at least a portion of NO to NO<sub>2</sub> for rare earth-based metals SCR catalyst but not transition metal/zeolite SCR catalysts. Andreasson discloses the following on page 2, lines 18-25:

Desirably, the  $\text{NO}_2/\text{NO}$  ratio is adjusted according to the present invention to the most beneficial such ratio for the particular SCR catalyst and CO and hydrocarbons are oxidized **prior to the SCR catalyst**. Thus, our preliminary results indicate that **for a transition metal/zeolite SCR catalyst** it is desirable to convert **all** NO to  $\text{NO}_2$ , whereas for a rare-earth based SCR catalyst, a high ratio is desirable providing there is some NO, and for other transition metal-based catalysts gas mixtures are notably better than either substantially only NO or  $\text{NO}_2$ . Even more surprisingly, the incorporation of a particulate filter permits still higher conversions of  $\text{NO}_x$  (emphasis added).

Clearly, Andreasson discloses conversion of all NO to  $\text{NO}_2$  prior to the SCR catalyst and not oxidizing the NO present in the exhaust gas to  $\text{NO}_2$  so that the exhaust gas contains **30 to 70 vol.% of  $\text{NO}_2$  before contact with the reduction catalyst**. Thus, Andreasson teaches away from the presently claimed invention by teaching that for a transition metal/zeolite SCR catalyst, **all** of the NO is converted to  $\text{NO}_2$ , not only 30 to 70 vol.% before contact with the reduction catalyst.

The present invention as claimed includes oxidizing some of the nitrogen monoxide present in the exhaust gas to **30 to 70 vol. % nitrogen dioxide before contact with the reduction catalyst**. This greatly improves the activity of the reduction catalysts mentioned and also decreases ageing of the catalyst (page 2, lines 30-34 and page 3, lines 1-2, 9-11). Further, an advantage of increasing the amount of nitrogen dioxide before contact with the reduction catalyst is to increase the activity of the catalyst at low temperatures (page 3, lines 11-12).

Andreasson teaches away from the presently claimed invention by teaching that for a transition metal/zeolite SCR catalyst **all** of the NO is converted to  $\text{NO}_2$  not only 30 to 70 vol.% before contact with the reduction catalyst. Since Andreasson does not teach, suggest or otherwise disclose all of the claim limitations of the present invention, a

rejection under 35 U.S.C. §103 is improper, and Applicants request withdrawal of this rejection.

**Rejection Based On Andreasson and Further In View Of Audeh Under 35 U.S.C. § 103(a)**

The Examiner rejects claims 2-5 under 35 U.S.C. §103(a) as being unpatentable over Andreasson and further in view of WO 96/01689 ("Audeh"). Applicants respectfully traverse this rejection.

Although the Examiner concedes that Andreasson does not disclose the transition metal used in the SCR catalyst, the Examiner argues that Audeh teaches a catalyst for the treatment of exhaust gases in which the catalyst is a zeolite that has been modified to contain iron. The Examiner concludes that it would have been obvious to one of ordinary skill in the art to modify the teachings of Andreasson with Audeh by using a transition metal/zeolite SCR catalyst containing iron for the reduction of nitrogen oxides.

Applicants respectfully disagree with the Examiner. To establish obviousness of a claimed invention, all claim elements must be taught or suggested by the prior art. As stated above, Andreasson does not disclose, teach or suggest oxidizing the NO present in the exhaust gas to NO<sub>2</sub> so that the exhaust gas contains 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst. Andreasson instead discloses that **all** of the NO is converted to NO<sub>2</sub> for a transition metal/zeolite SCR catalyst before contact with the reduction catalyst (page 2, lines 18-25).

Audeh teaches a catalytic process for the treatment of exhaust gas containing nitrogen oxides. Although Audeh teaches a zeolite catalyst that has been treated or modified to contain iron and may optionally include another metal such as a transition metal, Audeh does not disclose reducing the nitrogen monoxide for the exhaust gas to contain 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst.

In contrast, the present invention claims a process for reducing NO<sub>x</sub> present in a lean exhaust gas by selective catalytic reduction on a reduction catalyst using ammonia, where the some of the nitrogen monoxide is oxidized into nitrogen dioxide so that the exhaust gas contains 30 to 70 vol. % of nitrogen dioxide before contact with the reduction catalyst. Neither Andreasson nor Audeh mention oxidizing the NO present in the exhaust gas to NO<sub>2</sub> so that the exhaust gas contains 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst. Moreover, one skilled in the art would find nothing in Andreasson or Audeh alone or in combination that would disclose, teach or suggest the claimed invention or any reason for making it. Further, there is no motivation to combine the references in such a way to get the claimed invention. Therefore, an obvious rejection under 35 U.S.C. §103 is improper. Applicants request withdrawal of this rejection.

**Rejection Based On Andreasson and Further In View Of Vogtlin Under 35 U.S.C. §103(a)**

The Examiner rejects claim 9 under 35 U.S.C. §103(a) as being unpatentable over Andreasson and further in view of U.S. Patent No. 5,711,147 ("Vogtlin"). Applicants respectfully traverse this rejection.

Although the Examiner concedes that Andreasson does not teach using an electrical gas discharge to oxidize the nitrogen monoxide present in the exhaust gas, the Examiner argues that Vogtlin teaches a selective catalytic reduction process to enhance nitrogen oxide reduction, wherein the oxidation of nitrogen monoxide is carried out with an electrical oxidizer. Accordingly, the Examiner states that it would have been obvious to one of ordinary skill in the art to modify the teachings of Andreasson with Vogtlin by using electrical power to oxidize nitrogen monoxide.

Applicants respectfully disagree with the Examiner. As stated above, Andreasson teaches that **all** of the NO is converted to NO<sub>2</sub> for a transition metal/zeolite SCR catalyst before contact with the reduction catalyst. Andreasson does not disclose, teach or suggest

oxidizing the NO present in the exhaust gas to NO<sub>2</sub> so that the exhaust gas contains 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst (page 2, lines 18-25).

Vogtlin teaches a method for reducing NO<sub>x</sub> emissions by combining a non-thermal plasma gas treatment with selective catalytic reduction to enhance NO<sub>x</sub> reduction in engine exhausts (abstract and column 6, lines 34-37). Although Vogtlin teaches the use of electrical power to convert nitrogen monoxide to nitrogen dioxide, Vogtlin does not disclose reducing the nitrogen monoxide for the exhaust gas to contain 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst. Further, Vogtlin does not even mention how much nitrogen monoxide is converted to nitrogen dioxide let alone the percentage of nitrogen dioxide in the exhaust gas before contact with the reduction catalyst.

In contrast, the present invention claims include the oxidation of nitrogen monoxide to nitrogen dioxide so that the exhaust gas contains 30 to 70 vol. % of nitrogen dioxide before contact with the reduction catalyst. Neither Andreasson nor Vogtlin even mention oxidizing the NO present in the exhaust gas to NO<sub>2</sub> so that the exhaust gas contains 30 to 70 vol.% of NO<sub>2</sub> before contact with the reduction catalyst. Rather, Andreasson discloses that all of the NO is converted to NO<sub>2</sub> for a transition metal/zeolite SCR catalyst before contact with the reduction catalyst. Moreover, one skilled in the art would find nothing in Andreasson or Vogtlin alone or in combination that would disclose, teach or suggest the claimed invention or any reason for making it. Further, there is no motivation to combine the references in such a way to get the claimed invention. Therefore, an obvious rejection under 35 U.S.C. §103 is improper. Applicants request withdrawal of this rejection.

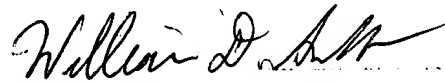
### **Conclusion**

All of the stated grounds of the rejections have been properly traversed, accommodated, or rendered moot. Thus, this amendment presents no new issues for

consideration. Entry of amendment, and reconsideration of the application is respectfully requested.

If a payment of any additional fee is required in connection with the filing of this Amendment, the Patent and Trademark Office is authorized to charge the account of such fee(s) to Deposit Account No. 11-0171, and to credit any overpayment, if any, thereto.

Respectfully submitted,



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